PKD infection in wild trout in Denmark with focus on wild farmed fish interactions

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PKD infection in wild trout in Denmark with focus on interactions between wild and farmed fish

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PKD – Proliferative Kidney Disease – is a parasitic disease caused by the myxozoan *Tetracapsuloides bryosalmonae*

- Common occurrence in traditional rainbow trout farms connected to natural streams
- The life cycle was previously unknown but in the late 1990es molecular tools assisted elucidation of the life cycle (Longshaw et al. 1999)

PKD

High mortalities due associated with PKD have been observed in Swiss (Wahli et al. 2002 and 2007) and Norwegian rivers (Sterud et al. 2007; Mo et al. 2011) – first year juveniles of trout and salmon seem particularly susceptible.

Symptoms of PKD

- External clinical signs:
  - pale gills due to anaemia
  - darkened body
  - abdominal distension
  - bilateral exophthalmia
  - lethargy
- Internal clinical signs:
  - renal swelling, often more prominent posteriorly
  - kidney turns from dark purple to red/pink or mottled grey
  - spleen is often enlarged and may have a rough appearing surface and liver may be yellow.
- Microscopic signs:
  - severe granulomatous response
  - degeneration of kidney tissue
  - parasite cells visible in renal tissue.

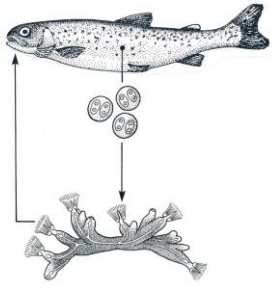
➢ Definitive diagnosis relies upon the detection of *T. bryosalmonae* in samples of fish tissue.

Effects of PKD

- Mortality highly variable
- Infected fish are susceptible to secondary infections (then often accompanied with high mortality)
- Fish may be superficially healthy, but can be very sensitive to handling and transport – susceptible to stress

(De Kinkeling & Loriot 2001)

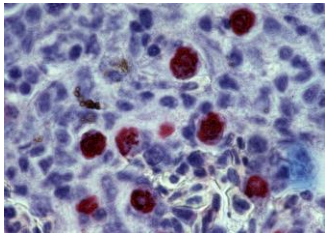
Tetracapsuloides bryosalmonae life cycle



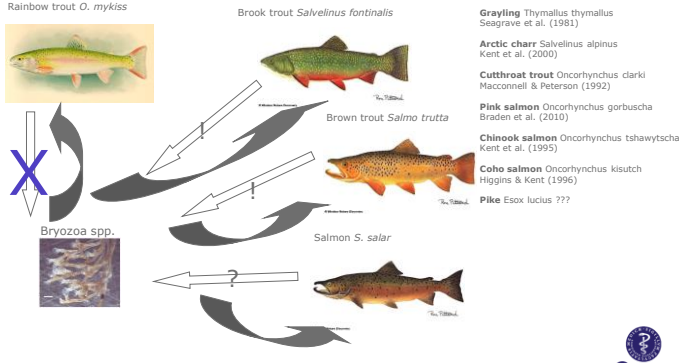
Buchmann & Bresciani 2001

Diagnosis based immunohistochemical and lectin histochemical techniques

Rainbow trout kidney section with *T. bryosalmonae* spores visualized by use of biotinylated *Bandeirea simplicifolia* lectins, avidin and FAST red



Transmission of *Tetracapsuloides* in Europe



(Morris & Adams 2006; Grabner & El-Matbouli 2008)

Recent development in Denmark

Traditional fish farm

Model trout farm

A survey of T. bryosalmonae in Danish salmonids:
Rainbow trout, brown trout and Atlantic salmon

Yellow dots: farms Red dots: natural streams

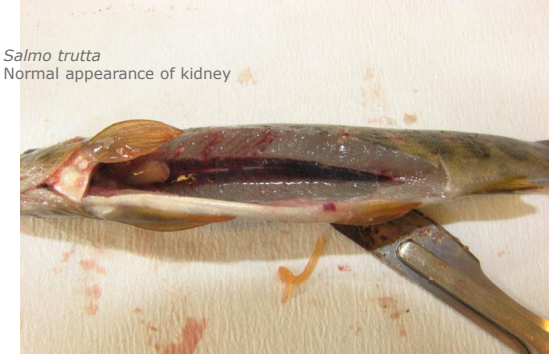
Fish (0+) collected November 2008 and 2009

Brown trout *Salmo trutta*: 112
From five freshwater streams in Jutland, Fune and Zealand

Atlantic Salmon *Salmo salar*: 31
From river Varde å

Rainbow trout *Oncorhynchus mykiss*: 37
From three freshwater farms

Salmo trutta
Normal appearance of kidney



Salmo trutta from a Danish freshwater stream

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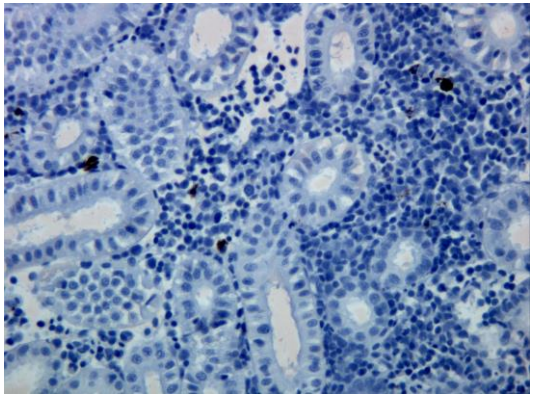
Salmo trutta from a Danish freshwater stream

UNIVERSITY OF COPENHAGEN

Healthy looking trout kidney – histological section



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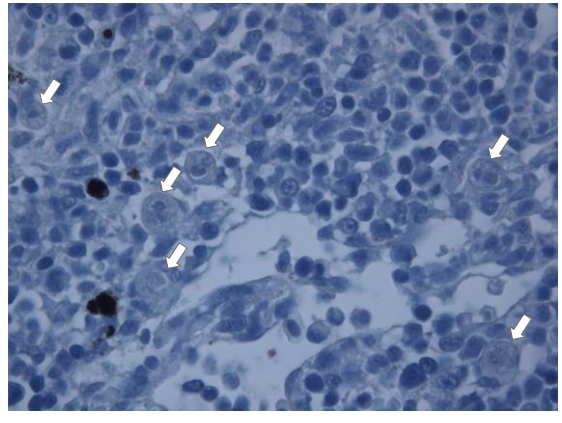
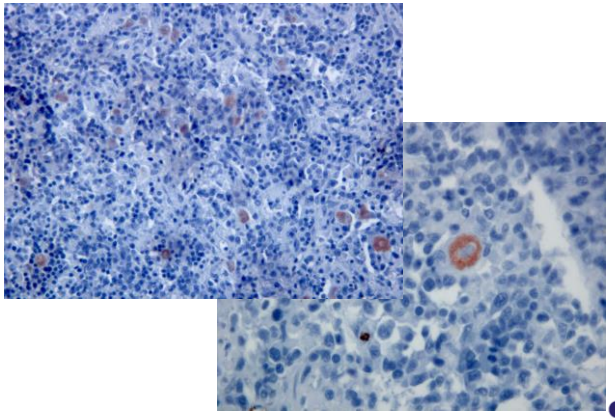
Trout kidney with PKD. Arrows = *T. bryosalmonae*

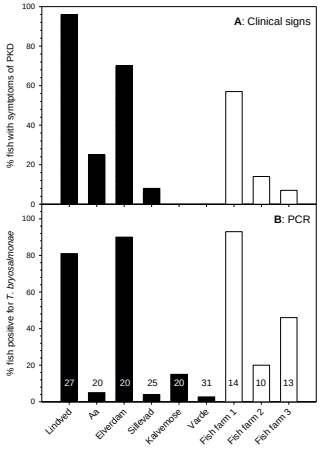


Lectin-staining of *T. bryosalmonae*



Detection of PKD using PCR

Black bars: brown trout
Except Varde (salmon)
White bars: Rainbow trout



Faculty of Health and Medical Sciences

PKD infection in traditional earth pond systems

Infection expected if water from natural streams with infected brown trout and bryozoans are present in the water system

PKD in model trout farms based on recirculation of water

- Avoiding intake of stream water (using spring/bore hole water)
- No intermediate hosts in the fish farm system
- No transmission from fish to fish
- No PKD infection to be expected except if infected fish are introduced from traditional earth pond systems connected to natural streams

Conclusions

Tetracapsuloides bryosalmonae is common in Danish streams and rivers.

A high percentage of wild Brown trout are infected with *T. bryosalmonae.*

Clinical PKD has been recorded in wild salmonids in Denmark.

Effects on wild host populations in Denmark are unknown.

The increasing use of model trout farms based on recirculation of groundwater will reduce the PKD impact on rainbow trout production in Denmark

Problems may continue in traditional trout farms

Thank you for your attention